

IN THE DRAWINGS

The attached sheet of drawings includes changes to Figs. 21-22. This sheet, which includes Fig. 21-22, replaces the original sheet including Fig. 21-22.

Attachment: Replacement Sheet

REMARKS/ARGUMENTS

Favorable reconsideration of this application, as presently amended and in light of the following discussion, is respectfully requested.

Claims 1, 2, 4-12, 16-32 are currently pending in this application. By this Amendment, Applicants canceled Claims 3 and 13-15 without prejudice and added new Claims 27-32.

In the outstanding Office Action, Figs. 21 and 22 were objected to; Claims 1-9, 12-16, 19-21, and 23-25 were rejected under 35 U.S.C. §103(a) as unpatentable over Arai (U.S. Patent No. 5,300,804) in view of Fig. 21 of Applicants' Admitted Art; and Claims 10, 11, 17, 18, 22, and 26 were objected to as depending from a rejected base claim, but were otherwise indicated as allowable.

With respect to the objection to Figs. 21 and 22, Applicants adopted the suggestion in the Office Action to label the figures as "Prior Art."

With respect to the amendments to the claims, Claim 1 is amended to include the elements of Claim 3; allowed Claims 10 and 11 are rewritten in independent form; Claim 12 is amended to include elements from Claims 14 and 15; support for new Claim 27 is found in original Claims 1, 7, and 8, for example; support for new Claims 28, 31, and 32 is found in Fig. 2, for example; support for new Claims 29 and 30 is found in original Claims 10 and 11, for example; and Applicants submit that no new matter is added.

Applicants respectfully traverse the outstanding ground of rejection because the outstanding Office Action fails to provide a *prima facie* case of obviousness as the asserted prior art, no matter how the prior art references are combined, does not teach every limitation of independent Claims 1, 12, 19, and 23.

To establish a *prima facie* case of obviousness, M.P.E.P. §2143 requires that three criteria must be met. First there must be some suggestion or motivation, either in the

references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the references teachings. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claim elements.

Claim 1 is directed to a semiconductor device including a semiconductor substrate. A first trench is formed in a surface of the semiconductor substrate and having a first side wall. A first impurity diffusion area is formed in the semiconductor substrate at a bottom of the first trench. A second impurity diffusion area is formed in the surface of the semiconductor substrate, having one end in contact with the first side wall, and having one end in contact with the first side wall, and having the same conductive type as that of the first impurity diffusion area. A first gate electrode is provided on the first side wall between the first impurity diffusion area and a second impurity diffusion area with a gate insulating film interposed therebetween. A first lower electrode is provided on the second impurity diffusion area. A first ferroelectric film is provided on the first ferroelectric film. A first interconnection layer is provided above the first upper electrode. The first contact plug is partly provided in the first trench and electrically connects the first interconnection layer and first impurity diffusion area. This configuration allows for a reduction in the aspect ratio of the contact connecting the first interconnection layer and first impurity area.

Claim 1 recites "...a first lower electrode provided on the second impurity diffusion area...." Neither Arai nor Applicants' Admitted Art disclose this element of Claim 1.

Arai is related to a mask ROM, and not to a semiconductor device that includes an upper electrode and a lower electrode. Rather than including upper and lower electrodes, Arai teaches a memory device that uses MOS transistor trains.¹

¹ Arai, col. 7, lines 29-30.

Arai addresses the problem of reducing the size of a mask ROM. Accordingly, Arai teaches reducing the size of a mask ROM by connecting MOS transistors in series on a sidewall, and forming two transistor trains connected in series and insulated and isolated from each other.² The configuration of Arai reduces size by reducing the area occupied on a plane on the surface of the substrate without considering the limitations associated with the gate length of the MOS transistor.³ Thus, Arai does not teach or suggest that a lower electrode is provided directly on a diffusion area.

Fig. 21 of Applicants' Admitted Art shows a first lower electrode 111 connected to source/drain diffusion area via contact 121. Thus, Fig. 21 does not teach or suggest the claimed "...a first lower electrode provided on the second impurity diffusion area...."

In addition, Arai does not teach or suggest "...a first contact plug partly provided in the first trench and electrically connecting the first interconnection layer and first impurity diffusion area."

Rather, Arai does not disclose any contact plugs because Arai is directed to a mask ROM. Arai also does not address the same problem that the Applicants addresses in the present application. Arai is directed to solving problems that arise when trying to reduce the size of a mask ROM. These problems are maintaining a distance between the source and drain so that punch through phenomenon can be restrained from taking place in the source-drain region, and spacing the gate electrodes.⁴ Arai teaches solving these problems by reducing the area occupied by transistors on a plane on the surface of the substrate.⁵

The problem addressed by the Applicants, and as described in the Specification at page 17, lines 14-19, is that the thickness of the interlayer insulating film between the gate electrode and the lower electrode can not be sharply reduced, since the reliability of the film

² Arai, col. 7, lines 20-23.

³ Arai, col. 7, lines 26-27.

⁴ Arai, col. 3, lines 7-32.

⁵ Arai, col. 7, lines 26-27.

would decrease by reducing the thickness. Thus, the distance between an upper electrode and a source/drain diffusion area cannot be reduced. As result of this, the aspect ratio of contact plug 132 of Fig. 21 is larger than the aspect ratio of plug 124. Applicants addressed these problems of the conventional art with the invention defined by Claim 1.

Fig. 21 of Applicants' admitted art does not disclose that the source and drain diffusion layer is formed at a bottom of a trench. The structure of Fig. 21 is different from the claimed structure of "...a first impurity diffusion area formed in the semiconductor substrate at a bottom of trench...." Therefore, the aspect ratio of contact plug 124 of Fig. 21, which connects an upper electrode and a source/drain diffusion area, is large and the structure of Fig. 21 does not solve the above-described problems of the conventional art.

In effect, the outstanding final rejection does little more than attempt to show that parts of the inventive combination of Claim 1 were individually known in other arts and to suggest that such a showing is all that is necessary to establish a valid case of *prima face* obviousness. The PTO reviewing court recently reviewed such a rationale and dismissed it in *In re Rouffet*, 149 F. 3d 1350, 1357, 47 USPQ2d 1453, 1457-58 (Fed. Cir. 1998) as follows:

As this court has stated, "virtually all [inventions] are combinations of old elements." *Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 698, 218 USPQ 865, 870 (Fed. Cir. 1983); see also *Richdel, Inc. v. Sunspool Corp.*, 714 F.2d 1573, 1579-80, 219 USPQ 8, 12 (Fed. Cir. 1983) ("Most, if not all, inventions are combinations and mostly of old elements."). Therefore an examiner may often find every element of a claimed invention in the prior art. If identification of each claimed element in the prior art were sufficient to negate patentability, very few patents would ever issue. Furthermore, rejecting patents solely by finding prior art corollaries for the claimed elements would permit an examiner to use the claimed invention itself as a blueprint for piecing together elements in the prior art to defeat the patentability of the claimed invention. Such an approach would be "an illogical and inappropriate process by which to determine patentability." *Sensonics, Inc. v. Aerosonic Corp.*, 81 F.3d 1566, 1570, 38 USPQ2d 1551, 1554 (Fed. Cir. 1996). To prevent the use of hindsight based on the invention to defeat patentability of the invention, this court requires the examiner to show a motivation to combine the references that create the case of obviousness. In other words, the examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select the elements from the cited prior art references for combination in the manner claimed. [emphasis added.]

There has been no such showing of those required reasons made in the rejection.

The Office Action states that it is inherent that the first contact plug is partly in the first trench. Applicants traverse this position.

None of the cited prior art, individually or in combination, disclose or suggest all the elements of Claim 1. Applicants submit the invention defined by Claim 1 and all claims depending therefrom, are not rendered obvious by the asserted prior art for at least the reasons stated above.

Furthermore, Applicants submit there is no teaching, suggestion, or motivation, either explicitly or implicitly, in either reference to combine the Arai with Fig. 21 of Applicant's Admitted Art. Thus, Applicants submit it is only through an impermissible hindsight reconstruction of Applicants' invention that the rejection of Claim 1 can be understood.⁶

Applicant respectfully submits that the assertion of inherency is insufficient to show that Fig. 21 of Applicants' Admitted Art inherently teaches the claimed "first contact plug partly provided in the first trench" because the rejection fails to provide evidence "that the alleged inherent characteristic necessarily flows from the teachings of the applied prior art"⁷

Applicants respectfully submit that Claim 1 (and its dependent Claims 2, 4-9, 11, and 31) patentably distinguish over the combination of Aria and Applicants' Admitted Art.

Applicants respectfully submit that Claims 12, 19, 23, and 27 (and their dependent Claims 14,

⁶ MPEP § 2143.01 "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge of one of ordinary skill in the art."

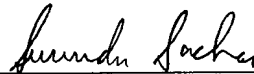
⁷ See MPEP 2112 (emphasis in original) (citation omitted). See also same section stating that "[t]he fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic," (emphasis in original). See also In re Robertson, 49 USPQ2d 1949, 1951 (Fed. Cir. 1999) ("[t]o establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill,'" citing Continental Can Co. v. Monsanto Co., 948 F2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991); and "[i]nherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient," Id. at 1269 (citation omitted)).

16-18, 20-22, 24-26, 28-30, and 32) patentably distinguish over the combination of Aria and Applicants' Admitted Art for at least the reasons given for Claim 1.

Consequently, in view of the above amendments and comments, it is respectfully submitted that the outstanding rejection is traversed and that the pending claims are in condition for allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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